AMERICAN JOURNAL *of* PHARMACY

SINCE 1825

A Record of the Progress of Pharmacy and the Allied Sciences

COMMITTEE ON PUBLICATION

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Vol. 103 JUNE, 1931 No. 6

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Price $3.00 per Annum in Advance Foreign Postage, 25 Cents Extra

Single Numbers, 30 Cents. Back Numbers, 50 Cents

Entered as Second-Class Matter at the Post Office at Philadelphia, Pa., Under the Act of March 3, 1879

Acceptance for Mailing at Special Rate of Postage Provided for in Section 1103, Act of October 3, 1917. Authorized February 15, 1920

PUBLISHED MONTHLY BY THE

Philadelphia College of Pharmacy and Science

43d Street and Kingsessing Avenue, West Philadelphia, Pa.

THE AMERICAN
JOURNAL OF PHARMACY

VOL. 103 JUNE, 1931 No. 6

EDITORIAL

STANDING ROOM ONLY—IF ANY!

IN JULY, 1925, we captioned an editorial in this JOURNAL, "The Banquet of the Elements." The last paragraph read thus:

"So there are now but three empty chairs at the great periodic table. . . .
And the voice of Moseley still persists.
'One by one' it echoes, 'until the total comes to ninety-two, not one more, not one less.' "

. . . .

Today, announcement comes of the discovery of the last of the vagrant three and at the great periodic table every seat has now been taken.

Toastmaster Hydrogen proudly presides at the table head and every guest is in his own belonging place.

To Seat No. 85 belonged the odd distinction of having been the last empty chair—empty—until four American chemists the other day dragged in the last remaining guest and showed it to its proper place with the rest of its elemental kin.

For the first time, then, in all the world's history—man can look upon this assembly of earth's elemental builders, with every member present, "ninety-two in number, not one more—not one less."

Science Service reports the discovery of this laggard element in the following paragraphs:

The one remaining unknown chemical element, number 85, has been detected for a first time in sea-water, in potassium bromide, and in a number of well-known minerals by a method of super chemical analysis so delicate that it can recognize one part in a hundred billion of water.

The discovery is announced by Dr. Fred Allison, Edgar J. Murphy, Prof. Edna R. Bishop and Anna L. Sommer working at the Alabama Polytechnic Institute here. Two of these, Dr. Allison and Mr. Murphy, are the same scientists who a year ago discovered the next to the last unknown element, No. 87, next door neighbor to radium in the chemist's table of the ultimate building blocks of matter. Ninety-two elements now form the completed list. The new element, eighty-fifth when the elements are arranged in the order of the weights of their atoms, is a family relative of iodine, long popular as an antiseptic. It has not yet been separated, for only one part in a billion is present in the substances examined.

However, in their letter to the *Physical Review,* in which the announcement is made, the discoverers say that concentration of a purer form of the element from monazite sand, is being attempted and is making good progress. The "eka-iodine," as Mendeleeff would have called it in his original periodic table, is being separated as the "85-ite" of lithium. Monazite sand is well known as the source of the cerium and thorium used for the mantles of Welsbach gas burners.

Other materials in which No. 85 has been found are: Kainite, a potassium magnesium sulphate found in the famous German Strassfurt salt deposits, apatite, which is a fluoride and phosphate of calcium and barium and fluorite, or calcium fluoride, as well as in the laboratory reagents hydrofluoric and hydrobromic acids.

An unexpected fact is noted that the acid formed from the new element, "85-ic" acid, does not show itself when nitric and hydrochloric acids, bromine and iodine are added to the solution but reappears when so-called reducing agents such as the dioxide of sulphur are present.

The new method of analysis depends on a strange phenomenon discovered a long time ago by Michael Faraday, one of the greatest scientists of all time. The Faraday effect has to do with what happens to a beam of light passing through a transparent substance placed between the north and south poles of a powerful magnet. The vibrations of the light beam, if polarised, that is, confined to one direction to start with, are found to have rotated on passing through the magnetized liquid.

About a billionth of a second elapses after switching on the magnet before the influence on the light vibrations is observed in the liquid. This lag is found by Dr. Allison and his associates to be different for different substances. It is this delay that gives a means

of identifying extremely small amounts of substances and in particular the first traces of the new chemical element 85. Because of its small amount the lag was not discovered until a year or two ago when Dr. Allison invented his new method of measuring it.

No satisfactory explanation of the phenomenon can be given on present theories, a fact which adds still further to the scientific interest of the work.

America seems to be making up for lost time in discovering the missing members of the chemical family. Until the discovery of illinium by Prof. B. S. Hopkins at the University of Illinois in 1926 no element had first shown itself to an American investigator. Illinium's discovery left only two more elements to be discovered in order to complete the chemical periodic table, that great generalization first discovered by the Russian chemist Mendeleeff in the 1870's and later elaborated by Moseley.

If the discovery of element 85 is confirmed by other investigators, the United States will have the distinction of having found the three last and therefore the most inaccessible of all the elements and the physical chemist can now draw comfort from the fact that he has at least touched the fringes of a realm which offers still vaster discoveries.

For the atom awaits without—without yet having yielded its power.

Ivor Griffith.

ORIGINAL ARTICLES

FOOD POISONING AND POISONOUS FOODS*

By Charles H. LaWall, Ph. M., D. Sc.

Dean of the Philadelphia College of Pharmacy and Science; Chemist to the Bureau of Foods, Pennsylvania Department of Agriculture.

"AND ELISHA came again to Gilgal: and there was a death in the land; and the sons of the prophets were sitting before him: and he said unto his servant, 'Set on the great pot and seethe pottage for the sons of the prophets.'

Charles H. LaWall, Ph. D., Sc.D.

"And one went out into the fields to gather herbs, and found a wild vine, and gathered thereof wild gourds his lap full, and came and shred them into the pot of pottage: for they knew them not.

"So they poured out for the men to eat. And it came to pass, as they were eating of the pottage, that they cried out and said, 'O thou man of God, there is death in the pot.' And they could not eat thereof.

"But he said, 'Then bring meal.' And he cast it into the pot, and he said, 'Pour out for the people, that they may eat.' And there was no harm in the pot."

Whether the sons of the prophet "dunked" or "crumbled" when they used this ancient "pot likker," the identity of the gourd mentioned in the foregoing passage from the fourth chapter of Kings II, has never been established, although Colocynth (bitter apple) or elaterium (squirting cucumber) have both been suggested nor does modern science know of any drug or poison to which meal would be so simple and effective an antidote. But the concise and emphatic expression "There is death in the pot" has been applicable upon many occasions throughout the centuries that have passed since Elisha's first aid antidotal treatment which proved so miraculously effective.

*One of a Series of Popular Science Talks given at the Philadelphia College of Pharmacy and Science, 1931 Season.

THERE IS DEATH IN THE POT

"There is death in the pot" was taken as the motif for a quaint and curious volume of a century and more ago. This book was by Frederick Accum and was a treatise on "Culinary Poisons." The cover of the London edition, dated 1820, is a weird conglomeration of intertwined snakes, with a skull and crossbones at the top and a spider web in the center with a spider waiting for its prey. Accum's book, however, deals mainly with the adulteration of articles of food or drink by methods that have long since been outlawed and suppressed.

In this lecture, I shall not discuss the subject of poisons as such, for that has already been capably handled in the lecture delivered in 1925 entitled "The Sign of the Skull and Crossbones" by my associate, Dr. Ivor Griffith; nor shall I devote any time to the common bacterial diseases transmissible to man through the agencies of food and drink, such as diphtheria, typhoid fever, tuberculosis, undulant fever, septic sore throat, etc., for they constitute a separate group by themselves, and are not food poisons in the true sense of the word; nor shall I discuss parasitic infections communicated by foods, such as tape worm, trichinosis and many others, for this subject was ably handled in 1927 by Dr. Marin S. Dunn in a lecture entitled "Animals That Live in Man."

What I have planned to do is to discuss the factors and conditions that cause severe and sudden illness and sometimes death, when people like you and me sit down to an apparently normal meal in a restaurant, or sometimes even in our own homes. I shall first destroy some illusions and contradict some misbeliefs.

THE PTOMAINE MYTH

The first phase of the subject that I shall take up is what I shall call the ptomaine myth. Everybody speaks of ptomaine poisoning, physicians who are not well informed employ the term, sometimes even in death certificate, and as for the newspapers, it is such a fine headline word that we see it almost every day. *There is no such thing as ptomaine poisoning, as the term is commonly used.* More than fifty years ago an investigator named Selmi coined the word "ptomaine," which comes from the Greek word meaning a corpse. The earlier conceptions of food poisoning which were then held, attributed the cause to chemical substances, and the views held in the middle of the nineteenth century were based upon the fact that putrefying flesh sometimes yields chemical compounds of a poisonous nature.

Selmi used the word "ptomaine" in a general sense as applied to chemical substances resembling alkaloids, which were supposed to be present in all putrefying meats and other foods rich in protein. Selmi never even succeeded in isolating any of these basic chemical substances to which he had given a name that was to be misunderstood and misapplied for many decades. Later, when several members of the group of ptomaines were isolated, analyzed and studied, they were given such names as *cadaverine* and *putrescine,* indicative of the advanced stage of decomposition which the flesh must undergo before these principles can be formed, and their toxic properties were found to be very much feebler than was at first supposed.

Ptomaines cannot be produced unless food actually putrefies, and as this condition could not exist under normal conditions of food handling, and as such food could not be prepared in a palatable form, it follows that the chances of being stricken by real ptomaine poisoning are much less than being struck by lightning.

Now, do not misunderstand me—I am not trying to convince you that food poisoning is rare, for it is, alas, too common. What I mean to emphasize is this—that there are perfectly logical and scientific methods of explanation of modern instances of food poisoning, but that these explanations entirely absolve ptomaines from any blame whatever, and to repeat again with greater emphasis, *there is no such thing as ptomaine poisoning as the term is commonly applied,* and anybody who uses the term to describe ordinary food poisoning is fifty years behind the times in his scientific knowledge and terminology.

Let me quote from a recent authority, Food Poisoning and Food Infections, by Wm. G. Savage, Cambridge Public Health Series, 1920:

> "Ptomaines are not, however, produced in the early, but only in the later stages of putrefaction and usually do not begin to appear until putrefaction has been in progress for a week. . . . They represent the late degradation products.
>
> "Under ordinary commercial conditions no one would be stupid enough to vend such food, no one would be rash enough to eat it. In other words, ptomaines are only produced when the food is far too nasty to eat. . . .
>
> "Experiments demonstrating toxicity by the mouth for ptomaines are very few and the writer has not come across any direct evidence that feeding with ptomaines prepared from putrefying meat has reproduced the symptoms of food poisoning. . . .

"The term ptomaine poisoning is clearly incorrect and its retention is unfortunate and misleading as it leads to a faulty conception of the pathology of the condition, and, what is worse, to the neglect of proper methods of investigation and correction. It is to be hoped that it will be speedily relegated to the limbo reserved for unsubstantiated theories."

As far back as 1888 the well-known investigator, Dr. Victor C. Vaughan, published a book on the subject of ptomaines and other toxic substances of similar origin, in which he pointed out that the greater majority of ptomaines discovered and identified up to that time were not poisonous, and that on account of this fact a German authority named Brieger wished to restrict the name "ptomaine" to the *non-poisonous* basic products obtained from decomposed food and suggested that the poisonous members of the group be called toxines.

The proper term to use to describe cases of illness from food, according to the latest authorities, is one of the following alternatives: food poisoning, food infection, or food intoxication; and if a specific term is to be used to denote the causative factor the generic word "toxin" is ordinarily applicable, although in some cases of inherently poisonous foods the active toxic substance may be specifically named.

TRIAL AND ERROR METHOD OF ANCESTORS

Food poisoning probably antedates civilization, for we cannot conceive of our stone age ancestors learning what was safe and what was poisonous except by the trial and error method, a method unconsciously followed at the present time by those who eat away from home. These early experimenters, when they paid the penalty for having made a mistake, by dying, usually left the surviving members of the family in the possession of some valuable knowledge which could be used for offensive as well as protective purposes. And so the empirical science of toxicology began first with the vegetable and animal poisons, and later with the mineral poisons, and official tasters became necessary to protect royalty from finding "death in the pot."

Sudden death is always mysterious, and it is entirely probable, in view of the extraordinary menus and prodigious appetites of our ancestors, as evidenced by the recipes and dining details of the cookery books of the past, that cases of suspected poisoning were in reality deaths from apoplexy or some other natural cause. The dramatic climax of Arliss' presentation of "Old English" is an illustration of a deliberate suicide by overindulgence in food and drink.

INHERENTLY POISONOUS ANIMAL FOODS

The list of inherently poisonous foods is fortunately a small one, and in our present well-supervised methods of food distribution there is little chance of such foods entering commerce. It has long been known that the flesh of certain animals and fowls becomes unwholesome at certain times, especially at the mating season, but this can scarcely be included in the category of poisonous foods. Certain fish are known whose flesh contains toxic substances of great potency, and in some others toxins develop within a few hours after death, but as all of these are of tropical or oriental origin we need not worry overmuch in the United States, although in Japan for some years they have averaged more than one hundred cases a year, over 70 per cent. of which were fatal. One of the most poisonous varieties of fish is the group of puffers, balloon fish or globe fish. The Japanese member of this group, called Fugu, is responsible for most of the fatalities and chemical investigation of this fish has resulted in the isolation of a toxic compound, which, surprising to state, is neither an alkaloid nor a protein, and whose lethal dose is four milligrammes per kilogram of body weight, corresponding to about five grains for an adult weighing 150 pounds. This is not a very toxic substance in comparison with some that will be mentioned later as occurring in foods.

In some other fish families, as the herring, tunny fish, sturgeon, and even such fresh water fish as the carp, barbel, and perch, certain parts of the fish such as the roe, are poisonous, particularly at certain seasons of the year. Shell fish are sometimes inherently poisonous and sometimes are poisonous on account of abnormal conditions of collection and handling. Mussel poisoning, with fatal termination, has been frequently reported, particularly in the British Isles, and a poisonous basic substance called "mytilotoxine" has been separated from them. This is believed to be primarily due to bacterial action upon mussels grown in polluted water.

Oysters and other shellfish eaten out of season sometimes cause gastroenteritis (diarrhœa) and urticaria (hives), but no deaths by oyster poisoning have been reported, except in the case of typhoid carried by oysters, which belongs in a different category from true food poisoning.

INHERENTLY POISONOUS VEGETABLE FOODS

There are comparatively few vegetable foods or substances which might be mistaken for foods, that are inherently poisonous. Of course, the poisonous properties of peach kernels and of bitter almonds are generally known, but there are few instances where a mistake could occur in this connection which might work harm. I do know of one occurrence, however, where a diabetic sufferer was told by his physician to obtain some almond meal for use as a food addition to his dietary, for almond meal is rich in protein and fat, but contains no starch or other carbohydrate. The patient ordered a supply from his pharmacist, who in turn procured it from a wholesale druggist, and the employee who filled the order sent bitter almond meal, which is sometimes used externally for cosmetic purposes. The warning odor of prussic acid and oil of bitter almond, when the almond meal was moistened, led the patient to defer eating the mixture until an investigation could be made, which was a fortunate decision and saved his life, for a pound of bitter almond contains hydrocyanic acid equivalent in amount to about 20 grains of potassium cyanide.

Cherry stones also contain prussic acid and both wild and tame cherries are reported as having caused the death of children who had eaten the kernels of these fruits. Hydrocyanic acid seems to be a poison which Mother Nature herself distributes somewhat lavishly, more generously, in fact, than human mothers do. It was during the Great War that the combined efforts of the Food and Drug Administration of the national government and the various State food bureaus were needed to keep out of the market a certain poisonous variety of lima bean, which looks like any other lima bean, but which contains hydrocyanic acid in amounts dangerous to health.

It is not generally known that the fresh root of the cassava plant, whose prepared starch we use under the name of tapioca, contains so much prussic acid as to be unsafe for eating. The method of preparing tapioca, however, eliminates all traces of the poison.

The water hemlock and poison hemlock are poisonous plants of very widespread distribution. Children frequently pull up the plants in early spring and eat the roots in mistake for wild parsnip or sweet cicely, for they all belong to the same family and have basic resemblances. Conium, as the second of these drugs is called, was the poisonous plant used in ancient Greece to execute those who were sentenced to death, and Socrates paid the penalty by partaking of the

"hemlock cup," which was not made from hemlock wood, as some infer.

It is in the group of mushrooms and other fungi, however, that man's deadly foods are found, and this phase of the subject has been so well handled in an earlier lecture in this season's course, entitled "Fungous Friends and Foes," by Professor Marin S. Dunn, that I shall refer only to the fact that there are only two very poisonous wild species in the United States that are likely to be mistaken for the common edible mushroom, one of which, the Fly Amanita, contains a poison which acts upon the nerve centers, while the other, called the Death Cup, kills by producing degeneration changes in the internal organs. Europe grows a larger number of poisonous fungi than America and some of these produce severe gastro-intestinal disturbances resembling the symptoms of poisoning by mineral substances.

It is only the super-timid soul who would fear being poisoned by the cultivated mushrooms sold in the markets, for the spawn, as the reproductive phase is called, can no more produce poisonous mushrooms than an acorn can produce a pine tree. Mushroom poisoning occurs only from so-called "wild" mushrooms, collected by inexperienced or ignorant persons. Such instances are as old as history itself. The whole family of the Greek poet Euripides was wiped out by such a tragic error, and Hippocrates, the Father of Greek medicine, wrote of mushroom poisoning as though it were of common occurrence more than 2000 years ago. Pliny mentions mushrooms as "dangerous food," while Seneca refers to them as "voluptuous poison."

The high mortality in cases of mushroom poisoning is due partly to the fact that the action of the poison is rapid, but principally because intelligent or antidotal or medical treatment cannot be given without knowing which variety of mushrooms has caused the trouble, for there are three types, as has been mentioned and the treatment would be different for each one. If you intend eating mushrooms of doubtful character please leave a specimen of the fungus for the botanist to identify so the physician may use the proper antidotal and corrective treatment, if he knows it.

SAINT ANTHONY'S FIRE

A type of food poisoning which was so prevalent in Europe at one time as to be epidemic, and which by some writers was confused with plagues due to specific infections, was called Saint Anthony's Fire, and was due to eating ergotized rye in which some of the individual normal grains

are replaced by a fungous growth which, when separated, constitutes the drug known as ergot. The appalling extent of this food poisoning condition is recorded by medical historians who report that in the tenth, eleventh and twelfth centuries, Germany, Flanders, Burgundy, Denmark and England, suffered terribly, whole districts being depopulated as by a plague.

Prayers and pilgrimages were of no avail, and each century took its toll until in 1676 a physician named Thuillier, who was a contemporary of Sydenham, pointed out the cause, and the removal of the ergot from the grain before grinding proved efficacious as a preventative, and science accomplished what appeals to the saints could not. It is fairly obvious that our ancestors of those early times were neither very particular about their food nor very observant as to possible causes of illness, for flour milled from ergotized rye, in which the ergot is allowed to remain, is discolored and has a sour objectionable odor. It takes a long while, however, for some peoples to learn, for there have been epidemics of St. Anthony's Fire within the last half century in sections of Prussia, France and Hungary, and there are still occasional outbreaks in Russia.

The effects of ergotism are manifested by involvement of the nervous system, followed by a degree of imbecility in one type of case, while in another type gangrenous effects are produced, resulting in a complete loss of external organs and members, as in leprosy.

LATHYRISM Another type of epidemic due to an abnormal food product is of comparatively recent occurrence, although it goes back to the time of Hippocrates. This is called lathyrism and is due to eating dried peas which have been contaminated with the seeds of a species of vetch which grow with and are harvested with the peas. The peas belong to the botanical family called Lathyrus, hence the name lathyrism for the disease or toxic effect that manifests itself in paralysis of the lower limbs. These effects are produced only in people who eat peas almost exclusively as a diet, as in some sections of India, although outbreaks have been reported in Algeria and also in France and in Italy. Since the facts have become known this dangerous condition has been almost eliminated by improved methods of cultivation and harvesting and subsequent cleaning and sifting of the peas so as to eliminate the poisonous vetch seeds, which are much smaller.

MILK SICKNESS

Milk sickness was an epidemic food disease in colonial America. In cattle it was called "trembles," "staggers," "slows," and a variety of other names. Lincoln's mother, Nancy Hanks, died of milk sickness, as is graphically described by Carl Sandberg in "The Prairie Years." The disease has almost entirely died out except for occasional outbreaks in more sparsely populated areas of Southern and Mid-Western States. As the name indicates it was a disease first manifested in cattle and communicated to man through the consumption of milk from the diseased cattle.

The alleged causes of milk sickness have been various. Swampy miasma, insect webs, dew, stagnant water, mineral poisons in the soil, mushrooms and other fungi, microbes, and other factors have each had their adherents. At present it is believed to be scientifically established that the disease is caused by toxic agents in a common plant upon which cattle sometimes graze. This plant is commonly known as white snakeroot (*Eupatorium urticae folium*). The identity of the toxic substance has not yet been established, so this chapter is still incomplete.

POISONOUS POTATOES

Potatoes were once looked upon as unwholesome by many persons, and this fear may have been due to a knowledge of the fact that there have been epidemics of poisoning traceable to potatoes. The cause assigned for such poisoning has been the presence of an alkaloid called solanine, which, however, is always present in normal potatoes in small amounts, but which at times may increase to abnormal proportions, especially when the potatoes are sprouting.

Some authorities minimize the idea of solanine being the cause and attribute such cases of poisoning to bacterial infection. This is another unfinished chapter, but without attempting to spoil anybody's appetite for potatoes, I would remind my hearers that potatoes belong to the same poisonous plant family that yields the nightshade and the datura, both of which are deadly poisons, but pshaw! so do tomatoes and egg plants, so why worry.

Poisonous honey has been reported occasionally and usually can be traced to bees of undiscriminating character having patronized plants whose blossoms contain poisonous principles. Staggerbush or andromeda is one of these plants, and the troops of Xenophon's army are supposed to have been poisoned in this way on an historic occasion.

Aconite was once mistaken for horseradish by an English cook's assistant who had been told to go out into the garden and dig up some horseradish and grate it and prepare a sauce. This mistake cost three lives, but the chances of such error are very slight.

So far we have had under discussion only natural foods such as meats, fish, shell fish, and vegetable foods. We must now turn our attention to the foods which are harmless and safe under ordinary circumstances, but in which, due to infection of the food with certain micro-organisms, combined with improper handling, poisonous qualities may develop. We are now approaching the most important phase of the subject, but we must not forget that there is a border line where certain foods are intentionally subjected to decomposing influences for the purpose of improving them. The decomposing factors may be bacteria, yeasts, molds, lower forms of animal life called amoebas, or even enzymes or ferments normally present in the tissues themselves.

DECOMPOSED FOODS THAT ARE NOT POISONOUS

We shun the very thought of such contamination, but we continue to drink and use sour milk, and even use it as a health adjunct without realizing that the souring of milk is brought about by bacterial infection of the milk itself and the conversion of the lactose into lactic acid; we eat the high flavored cheeses in spite of the fact that here sometimes we have bacterial changes of a putrefactive nature as in limburger cheese and its cousins, while the green blotches and streaks in well-ripened Roquefort cheese are due to the same green mould which we shun on other articles of food when they show signs of its presence. In short, the entire cheese industry is based upon the development and control of certain forms of bacterial spoilage, in which we have learned by experience, no toxic products are ordinarily developed, and in which higher organisms, sometimes visible to the naked eye, may be found. Finally, I would discourage any cheese lover from making a microscopic examination of his favorite variety.

In both milk and cheese, however, in the past, poisoning cases have been reported in which they were the causative factors. Indeed, Dr. Victor C. Vaughan in 1885 discovered a poisonous principle which he was able to isolate from abnormal milk, from poisonous cheese and from unwholesome ice cream; this principle he named *tyrotoxicon,* and it was found to produce the same symptoms in animals that the decomposed food from which it was isolated had previously produced.

The inauguration of modern sanitary methods of milk production and handling and the high ideals of sanitary control which are now effective in cheese making and ice cream making on the large scale have practically eliminated all danger from decomposed milk or milk products, at least so far as the type of decomposition yielding tyrotoxicon is concerned.

Another favorite food product with many persons is sauer kraut, which from the standpoint of the biologist is simply decomposed cabbage. It is, however, a controlled type of decomposition in which a bacterial fermentation is brought about that yields lactic acid as one of the end products, so there is a closer relationship between sauer kraut and sour milk than most people realize.

The succulent and luscious dill pickle is also a product of lactic fermentation, although many imitation dill pickles are on the market in which vinegar is used to replace the lactic acid, with a loss of identity and a dimunition of wholesomeness.

In China and Japan where the soy bean is used very largely a number of products are made that are the result of bacterial change. A good many epicures like game and other meat foods to be "high." This abnormal preference is one which is accompanied by some risk, although from the statistical standpoint the likelihood of harm is very slight. In this same connection we are confronted with the anomalous situation existing in the Orient, where the Indo-Chinese, Malays, and Polynesians seem to thrive upon decomposing fish, while in China ancient eggs have been buried in the earth for long periods during which bacterial changes take place that completely destroy the original characters of the eggs. These eggs are esteemed as a great delicacy and are sold for a high price.

The explanation of these apparent inconsistencies, according to modern bacteriological science is that putrefaction in itself does not necessarily develop poisons in foods thus affected unless the food is also affected with a specific organism of one of the types that yield toxins, such as the botulinus bacillus or the paratyphoid bacterium, both of which will be discussed in turn presently.

When grape juice encounters yeast, a form of decomposition ensues called fermentation. Some people think that this change ruins the grape juice, while others hold the view that it is greatly improved. The final decision as to which of these two views is correct will probably never be reached. The controversy has been going on since the time that "Noah planted a vineyard" and will probably not be settled

when the "traveler from New Zealand shall, in the midst of a vast solitude, take his stand on a broken arch of London Bridge to sketch the ruins of St. Paul's."

BOTULISM

Now let us turn to food poisoning proper and discuss some specific types. I shall take up first botulism, because although it is very rare, yet it is the most deadly form of food poisoning, and has been given so much publicity in recent years, that many persons in Europe and America have denied themselves the pleasure and satisfaction of eating certain foods because of the fear of this sudden and (to the laity) mysterious effect.

Botulism results from the toxins produced by the bacillus botulinus, a soil bacterium of rather wide distribution, especially in the western United States. It was recognized as a distinct type of food poisoning in the eighteenth century and was first described by a Schwabian poet and physician named Justinus Kerner in 1820. For more than a century it was called "Allantiasis," a sausage poisoning, from the Greek root combining word *allant*, meaning sausage, because it was noted only in connection with sausage or potted meats. In 1894 a German investigator located the specific organism which causes the condition and named it *bacillus botulinus*, from the Latin *botulus*, a sausage.

While in Europe it was observed only in food poisoning resulting from the eating of sausage or potted meats, in America it soon came to be associated with the eating of canned vegetables, particularly home canned products. In this country it has been traced to the following rather wide range of foods: ripe olives, asparagus, string beans, peas, carrots, spinach, home-made cheese, Chili sauce and relishes. A few cases have been reported in which meat foods, such as ham, were at fault, but these are in the minority. Not many cases of sausage poisoning have been reported in America, because our animal food packing industry has been conducted upon a high plane of sanitation ever since the appearance of Upton Sinclair's "Jungle," and the "embalmed beef" scandals of the Spanish-American War.

No cases have ever been traced to canned fruits or to pickled or salted food products and it is never caused by fresh foods. The organism itself is not harmful when taken into the system, for it cannot live and reproduce in the body environment. It is only when it finds its way into certain kinds of canned foods which are not prop-

erly sterilized that it grows and produces its toxin that is the most deadly poison known to science.

Domestic animals sometimes suffer from the effects of the organism. In chickens it is called "limberneck" and is usually communicated through garbage containing it. In horses and cattle it is called "grass sickness," and the cause is obscure. There is usually no remedy for the poisoning and symptoms are treated as they arise. There is also no assurance of safety in refraining from certain foods, for the list is so large that one would have to live on a very restricted diet.

Botulism is rarely produced by commercially canned or packaged vegetable foods. A severe outbreak in this connection was reported about a decade ago, with ripe olives as the causative factor. The investigation in this case revealed the fact that all of the packages containing the organism were of large size, and the containers were of glass and not tin, and further investigation showed that this type and style of container could not be satisfactorily sterilized without breakage and loss, and has since been discontinued. In Pennsylvania a thorough investigation was made of the ripe olive situation in 1921 and out of hundreds of packages that were examined, representing every commercial source, variety and size, two lots only were found to be contaminated, and these were of the large size already mentioned, and which no longer appear on the market; yet there are thousands of people who like olives who have deprived themselves of this wholesome and nutritious food (both ripe and green varieties) since the previously mentioned outbreak, for no good reason whatever, for there has never been a case of botulinus poisoning attributed to ripe olives since 1921, so far as I know, and it is impossible for botulinus contamination to occur in green olives on account of the high salt content of the brine.

The rarity with which this infection occurs in commercial canned foods is attested by the fact that during the World War not a single case of botulism was reported in the Army, although millions of tins of commercial canned foods were consumed. The collected statistics show that the majority of cases of botulinus poisoning occur in *home* canned products, and especially in foods put up by the cold pack method which has been found to be ineffective in killing the organism when it is known to be present.

The fear of botulism is caused by the high mortality shown in the reported cases (nearly 70%) and the suddenness and severity of

the symptoms. Within the past month a case was reported in North Dakota where twelve persons died as the result of eating a salad in which home canned peas was the obvious cause, for only those who ate the salad were afflicted and every one of these died. The *Journal of the American Medical Association* for March 7, 1931, comments upon this case as follows:

"Botulism and Home Canning.

"Again attention must be directed to an outbreak of botulism from home canned vegetables, presumably canned by the so-called cold pack process. In this, the first outbreak to be recorded for 1931, the causative food epidemiologically was a salad made up from two glass jars of a mixture of home canned string beans, peas and carrots. The outbreak occurred in Grafton, N. D., following a party given on the night of January 29. Seventeen persons attended the party; twelve are dead, probably all who showed symptoms of botulism. Heretofore, home canned string beans have caused outbreaks of botulism far in excess of any other food. Home canned string beans, even when mixed with carrots and peas, canned by the cold pack process, are a potential menace to the health. They should always be boiled before being served. Departments of home economics in agricultural colleges, universities and their extension divisions throughout the country should plan a vigorous educational campaign to prevent these deaths. Unfortunately, many of the recipes for the home canning of vegetables antedate the present-day knowledge of botulism and with few exceptions no effort has been made to correct them. Admittedly it is difficult to reach those who are endangered by foods inadequately preserved in the home. Nevertheless, the public should be told with unremitting insistence that string beans and every non-acid vegetable may be rendered safe by sterilization for a sufficient time and temperature in a pressure cooker, by drying, or by the addition of a 10 per cent. brine solution to the cold pack method. Enough information is now available to enable authorities to formulate definite rules to guide the home canner. Most of these facts were fully brought out in the original report of the California Botulism Commission."

The symptoms of botulinus poisoning are very different from ordinary food poisoning. Dizziness, blindness or double vision, numbness, and finally death by respiratory paralysis are the most outstanding symptoms. Vomiting and diarrhœa are very rarely reported and when present, are mild and transitory. The symptoms rarely appear under twelve hours after eating the food and sometimes are delayed

as much as thirty-six hours, although the extreme range in reported cases has varied from two hours to eight days.

How may one avoid such a terrible affliction, is a very pertinent question. The answer is simple. Don't take any chances with a food product that is not normal in appearance, taste, or odor. In most of the reported cases where a cook or hostess lived to tell the tale, the investigation has revealed that the food was soft and mushy or had a peculiar odor. A cheesy odor, either slight or marked, is an unfailing accompaniment of botulinus infection. Where such abnormal odor is noticed in any of the kinds of food previously named as being susceptible to botulinus infection, do not use the material; do not even taste it, for a small fraction of a teaspoonful of the liquor from canned string beans infected with botulinus has been known to cause death, and a single small bite of a ripe olive containing the toxin has resulted fatally. Fortunately, the botulinus toxin is very readily destroyed by heat, and therefore cooked foods are safe from this danger. It is when such infected foods are used in salads without recooking that they are dangerous. The type of sausage that has caused the trouble abroad, and the potted meats too, have all been of the type that are eaten cold as luncheon dishes.

Efforts have been made to develop an antitoxin against botulinus, but as there are several strains or types of the bacillus the serum therapy of this kind of poisoning is not yet established on firm scientific ground, as it is in such diseases as diphtheria and tetanus.

FOOD POISONING FROM BACTERIA OF THE PARA-TYPHOID GROUP

But now let us turn our attention to the most common type of food poisoning, the kind that is popularly known as ptomaine poisoning, in which the symptoms are more or less similar and include acute, severe and violent derangement of the alimentary tract, accompanied by severe abdominal pain, vomiting, diarrhœa and prostration, with or without fever. The mortality in such cases, which are all too common, is fortunately very low, but the after-effects are long-lasting and frequently produce serious impairment of the general health.

The generally accepted view that tainted meat is a cause of illness is not supported by scientific evidence. Tainted foods of all kinds, especially meat and eggs, are universally shunned, and quite properly so, because if they are tainted they are undergoing bacterial change and may be specifically infected, but neither the degree of the

putrefactive change nor the precise cause of its harmfulness has been placed upon a scientific foundation as yet. In other words, you may eat a fairly putrid piece of meat, as was intimated when we discussed "high" game, or consume a rotten egg, such as a century old Chinese egg, with impunity, if they are simply undergoing normal bacterial decomposition of the non-specific type, but the danger of eating such rotten food lies in the fact that the specific organisms may be present, and it is unwise to take a chance.

The first step in the really scientific study of the causes of food poisoning antedated the investigation and naming of the bacillus botulinus by Van Ermengen in 1895. It was instituted by a German investigator named Gaertner in 1888, when he isolated *bacillus enteriditis* from the material afforded by an autopsy in what otherwise would have been reported as a fatal case of "ptomaine" poisoning. Since that time this same organism or others related to it have been isolated in the course of investigations following outbreaks of food poisoning, and there is no doubt in the minds of authorities on the subject of food poisoning that this group of organisms causes most cases of such illness.

The organisms responsible for the toxic effects are a group known as the *paratyphoid-enteriditis* group, which are intermediate between *bacillus typhosus* (the cause of typhoid) on one hand and *bacillus coli* (the normal intestinal organism in man) on the other. The infection with such organisms may develop in a very wide range of foods, but is especially likely to occur in beef, pork, milk, milk products, eggs, puddings and salads. A number of outbreaks of poisoning have been traced to duck eggs which had been infected with these organisms before the egg was laid. The poisonous effects were noted in meringues as well as in other foods prepared from such infected eggs. The infection, upon investigation, was found to be localized in the albumen.

As regards the taste, odor, appearance, and texture of such infected food, there has been some difference of opinion. In some cases the food has been observed to be "off" in flavor, odor, and appearance, while in others there is no obvious change whatever. In one classic instance in Europe, where meat was suspected as the cause of a food poisoning epidemic of the *bacillus enteriditis* type, the inspector was so certain that the meat was not the cause of the epidemic that he insisted on eating several pieces of it. Three days later he was dead

and the investigation following the post mortem showed the *bacillus enteriditis,* as in the other cases. This group of organisms is also called the "Gaertner" or "Salmonella" group.

Fortunately for mankind the bacilli are not spore-forming and are easily killed by heat. The toxins, however, are heat resistant, which explains some of the unusual effects noted in food poisoning cases of this type. In some few instances the infection has taken place in the animal itself, which was diseased at the time of slaughter. In most cases, however, the infection takes place in the food itself, before, during, or after preparation and through faulty handling, or incomplete cooking, or both, the food becomes toxic.

Foods which have been frozen, and cold storage foods, are particularly susceptible to infections of this type, as are improperly handled meats, fish, shell fish and crustaceans. Occasionally sausages, bolognas, potted meats and meat pastes are reported in this group of food poisoning cases instead of in the botulinus group, where they also belong. The kinds of foods that are most likely to cause the paratyphoid infection at banquets, etc., are the cream soups and cream sauces that are used with such dishes as chicken a la king. When these are made on the very large scale and allowed to cool slowly, or kept partly warm until time to reheat them for serving, if infection has taken place by bacteria of the Gaertner group, there is afforded an ideal culture medium and a favorable incubation temperature which causes the sauce to work havoc among the diners later on. Hotel chefs and caterers should be taught never to hold foods for a long time at a lukewarm temperature, which favors incubation or rapid growth of bacteria. Foods of certain types should either be held at very cold temperatures or should be kept very hot. As conditions favorable to the multiplication of bacteria are more likely to occur in large batches than in small ones, this explains why cases involving large numbers of persons occur more frequently than instances of food poisoning of individuals caused by home prepared foods. Reheating such foods does not make them safe, for, as previously mentioned, the toxins of this type of infection are not destroyed by cooking.

Milk products, such as cream fillings or whipped cream fillings used in certain types of pastry are also very susceptible to such infections and are frequently reported as the cause of food poisoning; so are gelatin desserts when kept for too long a time before serving. All of these possibilities, however, may easily be and should be

avoided by proper education of hotel chefs, caterers, bakers, and others who prepare foods which are likely to become harmful if improperly prepared or kept too long. It is well to emphasize the fact that if infection has taken place and toxins have been formed, later cooking of the food will *not* render it safe, for while the bacteria are easily killed by heat, *the toxins are not rendered harmless* by any amount of cooking.

The paratyphoid type of food poisoning is rarely reported as being caused by canned foods. It cannot be too strongly emphasized, however, that any canned food in which gas has accumulated to the extent of causing the ends of the can to bulge (these being called "swells" in the trade) must be looked upon with suspicion, and discarded if the contents are in the least degree abnormal.

FOOD IDIOSYNCRASIES

There is a type of food poisoning which, strange as it may seem, is akin to hay fever. This is called "food sensitiveness," which is a purely descriptive term like food poisoning, and like the latter term means nothing scientifically definite. We also use the verbal subterfuge "idiosyncrasy" to describe this condition. We now know the scientific explanation, but scientists have disguised it under the name "anaphylaxis," and when we are able to overcome the condition by bestowing acquired immunity upon the sufferer, we call it "allergy." If you ever suffered from the rash which appeared some time after the buckwheat cake season had started, you were suffering from this type of food poisoning. If you suffer from hives every time you eat strawberries, you are a victim of sensitization towards strawberries—which is to say that you have an idiosyncrasy toward that delicious fruit. Ignorant or uninformed persons, including some physicians, attribute the condition to the acidity of the strawberries, which not only does not explain why other acid fruits (containing the same acids) can be eaten with impunity by the same individual, but is incorrect as well, for all of such cases of food sensitization are due to the proteins present in the foods, and immunity or temporary relief may often be acquired by feeding minute, gradually increasing, doses, accurately controlled as to quantity, of the purified protein of the offending food—just in the same manner as hay fever or asthma sufferers are relieved by doses of the pollen extract made from the pollen of a particular plant which causes the trouble. It may be said in passing that the respiratory symptoms are often caused by animal hairs, dandruff, or feathers from particu-

lar varieties of fowls; indeed, household pets are often the unsuspected cause of so-called hay fever, which might more appropriately be called cat-fever, dog-fever, etc., were it not for the fact that fever symptoms are usually lacking, and the entire nomenclature is faulty.

It is no joke, however, to go through life suffering from an abnormal sensitization to some particular food. It is sometimes easy to avoid the offending food, for one *can* go without buckwheat cakes and it is within the power of individuals to deny themselves the pleasure of eating the berry so highly praised by Dr. Samuel Johnson, but when it comes to the eggs, milk and milk products, and particular cereals, it approaches tragedy. Let me give you an example of egg sensitization:

> "Long, in the *Journal of Cutaneous Diseases,* records an extreme case of sensitiveness to white of egg in a boy. No effect was noticed when egg was first given to him at the age of ten months, but when next given, when fourteen months old, after only a taste of it 'he cried out and clawed at his mouth,' while his lips, tongue, and the mucous membrane of the mouth immediately became enormously swollen, while urticarial wheals (hives) appeared about his mouth. He did not, however, become generally ill. Toward the end of his second year, while playing with egg-shells, urticarial wheals appeared on his hands and arms. This occurred several times until his mother realized the cause of the urticaria. At twenty-two months one-eighth of the white of an egg in milk was immediately followed by swelling of the mouth, urticaria and vomiting. Given egg-white again when two years old more severe symptoms were present, as not only were those above mentioned induced, but also marked flushing, increased respiration, vomiting, muscular twitching followed by a semi-comatose condition. Complete recovery after three hours. In this case somewhat similar symptoms resulted when five years old after eating an almond and a Brazil nut."

Here is a report showing a number of cases of food idiosyncrasy:

> "McBride and Schorer (1916) collected particulars of sixty cases of food sensitization causing skin lesions. These were more often urticarian than erythema. In their series fish, tomatoes and cheese produced only urticaria, while eggs usually were followed by urticaria, but not invariably. Cereals and pork caused erythema in a considerable percentage of the cases, the lesions usually appearing within less than four hours of eating the food; tomatoes and cereals generally produced these symptoms in less than an hour, while with fish, nuts and cheese symptoms were for the

most part delayed until after four to twelve hours. The eruption itself usually lasted from one to twelve hours, but in a small percentage of cases from one day to a week. In some instances there was also involvement of the respiratory tract; this varied from a slight cough to a severe dyspnœa. More than half of the cases of egg sensitization showed these symptoms, while they also occured in a considerable proportion of those resulting from the consumption of fish, cereals and pork."

A list of the most commonly reported foods toward which sensitiveness is exhibited by certain individuals is as follows: almonds, Brazil nuts and other nuts, eggs, milk and milk products such as cream, cheese, etc., fish and shellfish, pork, and (rarely) beef, cereals such as rye, oats, wheat, and particularly buckwheat, strawberries and tomatoes. Sometimes this susceptibility exists from infancy, sometimes it is inherited, and sometimes, but rarely, it is acquired in later life. If you have such an affliction, you are deserving of sympathy, but, as Dr. Munyon would say, "there is hope," for scientific pharmacy and medicine have provided relief in the shape of what are called "antigens" or allergic protein preparations. These are used both for diagnosis and treatment. The list of available preparations is already quite extensive and the proteins are marketed in small vials containing 500 protein units per cc., each unit representing a thousandth of a milligram of the specific protein (which is 1/65000 of a grain).

The degree of the accurate and painstaking calculation of dosage and the small amount of the original food material represented by 500 units is illustrated by the strawberry. A very small single berry, weighing one-eighth of an ounce, would represent 15000 units or thirty doses of strawberry protein. Verily here we are encroaching upon the domain of homeopathy and Hahnemann is vindicated, for such doses actually bring relief if the treatment is properly followed under competent medical supervision.

The list includes the proteins of the following foods: almond, apple, asparagus, banana, barley, lima bean, navy bean, string bean, beef, beet, buckwheat, butternut, cabbage, cantaloupe, carrot, cauliflower, celery, cheese, cherry, chicken, clam, cocoanut, cocoa, codfish, coffee, corn, crab, egg yolk, egg white, egg plant, garlic, ginger, goose, grape, grape fruit, haddock, halibut, herring, lamb, lettuce, lobster, mackerel, milk, mushroom, mustard, nutmeg, oat, onion, orange, oyster, paprika, parsley, parsnip, peach, peanut, pea, pear, pecan, pepper, pineapple, pork, potato, prune, raisin, rice, rye, salmon, shrimp,

sole, spinach, squash, strawberry, sweet potato, tea, tomato, tuna fish, turnip, veal, black walnut, English walnut, and wheat.

Here are eighty foods, all of which have been known to produce symptoms of poisoning, when the food is normal but the individual is not.

Perhaps those of us who have never been made acutely ill by normal foods have acquired the tolerance or acquired immunity toward certain substances, as is evidenced in the case of tobacco users. And perhaps, too, some inexplicable cases of food poisoning may be due to temporary susceptibility or sensitization toward normal foods, for the symptoms include nausea, vomiting, diarrhœa, cramps, and other intestinal disturbances, hives, rashes of various kinds, difficult breathing, and even incoordination of muscular effort. All of these symptoms are exhibited in true food poisoning by infection or toxins.

Now let us turn our attention to a few instances of food poisoning belonging together in a group which are easily preventable. I refer to the occurrence of chemical poisons in food, usually through careless preparation or the use of improper ingredients or utensils. If one makes lemonade in a galvanized pail, the fruit acid will dissolve enough zinc to produce severe illness in those who partake of the beverage. If a silver cleaning compound containing cyanide is carelessly used or allowed to stand around in close proximity to food, accidental contamination of the food may occur, and while the chances of this are rather remote, it is serious enough to have inspired legislation prohibiting the use of such cleaning compounds in hotels and restaurants, in some communities. There is langer also of the compound not being entirely removed from the silver after cleaning.

Arsenic is not regarded as a poison that could easily find its way into food unless intentionally added, but a serious instance of poisoning of thousands of people with arsenic occurred about thirty years ago in Great Britain. The total number of cases actually treated was more than 6000, and 70 deaths were proven to have resulted from this cause. The actual number of cases and deaths must have been considerably higher. The cause was beer which contained arsenic. The beer had been made from impure glucose that contained arsenic, the poison having been contributed by the arsenic-contaminated sulphuric acid that was used in manufacturing the glucose.

A royal commission investigated the situation and reported upon the facts. Steps were taken to insure the freedom of future supplies

of beer from arsenic, and but few outbreaks of such poisoning have been reported since, one of these being in Halifax in 1902, traceable to beer, and one in Manchester in 1908, traceable to confectionery which had become contaminated with arsenic, presumably from the glucose employed in its manufacture.

No such outbreaks have ever occurred in America for the reason that American glucose has never been made from arsenic-contaminated sulphuric acid and has never been found to contain arsenic. A few years ago Federal, National and State food officials of America and Great Britain were greatly exercised over the possibility of arsenical poisoning which might result from the arsenical spray residue that might remain on apples and pears in consequence of improper spraying of the apple and pear trees for the suppression of the codling moth.

This question of arsenical spray residues on fruits and vegetables is by no means settled, but I would like to assure my hearers that the condition is pretty well under control at the present time. Just the same, I would suggest that apples or pears be washed or peeled before eating out of hand or using for culinary purposes, for the polished apples on sidewalk stands sometimes furnish worse hazards than arsenical poisoning.

Antimony is another poisonous metal that has been reported as the cause of food poisoning. Certain types of enameled kitchen ware have been known to contribute antimony compounds to foods cooked in them, and the use of red rubber fruit jar rings has contributed to the same hazard, for antimony compounds have been used in enamels and as a constituent of red rubber.

Lead is another poisonous metal which was more commonly used in former days than it is at present. Compounds of lead have also been used in enamels and glazes, lead pipes have been used for conveying water and sometimes in factories for transporting liquids or lining tanks. Lead is absent from solders used in the canning industry for the reason of its potential danger.

Copper is a constituent of the commonly used alloy called brass, and in itself is sometimes used for cooking utensils. If copper in minute amounts were very harmful, many of our ancestors must have suffered from copper poisoning, for one has but to look at the ancient tea kettles and preserving kettles, etc., to realize the almost universal use of copper utensils at one time in the household. Numerous cases

of copper poisoning, however, have been reported, some of them serious. It is probable that the potential harm from copper utensils is minimized by keeping them clean, for dirty or tarnished utensils are coated with compounds of copper which are readily dissolved—much more so than polished copper or brass would be.

The question of the harmfulness of tin salts has never been definitely settled. Some foods attack the tin coating of so-called "tin" cans more than others. This subject has been very thoroughly investigated by commissions, committees, and individuals. While some cases of acute tin poisoning are on record the number must be very small in proportion to the number of tins of foodstuffs used, for it is estimated that over five billions of cans (or tins, as the English call them) are used in America alone each year.

Preservatives as food poisoning hazards have practically disappeared since the passage of the Federal Food and Drugs Act of June 30, 1906, but the repercussions and echoes of the hectic period which included the reports of the "Wiley Poison Squad" and the Remsen Referee Board have not entirely died out even yet. We still have sodium benzoate and sodium sulphite as permitted preservatives, although it is interesting to note here that many of the "die hard" supporters of sodium benzoate as a necessary preservative in the battles of 1907 to 1912 were suddenly transferred to the "no preservative" ranks of food manufacturers, when in 1916 the cost of sodium benzoate increased from 50 cents a pound to $9 a pound, in consequence of the shortage of supplies during the War. It is interesting to note, too, that as far back as 1898 the Imperial German Board of Health forbade the use of sulphites in food on account of harmfulness, while the dried fruit manufacturers of California are still permitted to drug their wares with unlimited amounts of sulphites, although Dr. Wiley's Bureau of Chemistry had shown the California fruit dryers a method of eliminating the use of sulphite several years before Dr. Wiley himself was eliminated from the Bureau of Chemistry for unswervingly giving the food consumer the "benefit of the doubt" in debatable cases.

Only one who has actually been an analyst of foods and beverages prior to June 30, 1906, can appreciate what poisons the American consumer of the present day has been spared by the passage of that important act, and the many supporting measures of the individual States, particularly Pennsylvania, where the enforcement of

food laws is more efficient, I believe, than even under the Federal Act. Formaldehyde, salicylic acid, boric acid, fluorides, betanaphthol, and many other preservatives were use *ad libitum* by many food and beverage manufacturers, who also used the harmful colors such as lead chromate and poisonous aniline colors, with no regard for their possible effect upon the consumer. Such days are happily of the past, and we need today but to protect ourselves from food contaminations of an unforeseen character, or affecting the pocketbook rather than the health of the consumer.

There is a tendency at the present time to attempt to influence health in such broad ways as by the intentional introduction of iodine compounds into water supplies, or the unrestricted sale of iodized salt, and even iodized eggs. The wisdom of mass medication is doubtful and its expedience and even its legality are questions yet to be determined.

The modern craze for so-called vitamized foods and the propriety of such slogans as "Have you had your iron today?", coupled with statements of the iron content of certain foods, which statements are of questionable propriety and truth, are trends which may have to be curbed in the future in the interest of public health, for we are by no means certain that an excess of certain vitamines or of mineral compounds will not be as harmful to the individual in the long run as a deficiency of the same food constituents.

While we are on this subject let us take a pot shot at the food faddists who insist that cereals and fruits are nutritionally incompatible, or who tell us never to drink milk with lobster or crab. Of such misbeliefs are cults and superstitious practices instituted. There is neither scientific nor clinical evidence that there is any truth in such generalities, which are probably based upon the experience of some individual who has an idiosyncrasy in connection with such a combination. There are persons who cannot drink coffee at an evening meal for fear of insomnia, and yet these same persons can consume tea with no such insomniac effect. Science shows the sleep-postponing ingredient to be caffein, which is present in a cup of tea in slightly higher proportion than in a cup of coffee, both of average composition. How come?

Well, now that we know the worst what can be done about the matter? How can we minimize the dangers of food poisoning? Here are a few don'ts that will reduce the possibilities to a minimum:

Don't eat any food that looks abnormal.

Don't eat any food that does not taste right.

Don't eat any food that has a peculiar, disagreeable odor.

Don't use any canned food from a swelled can in which gas has formed.

Don't take any chances with home canned non-acid vegetables, such as beans, asparagus, carrots, spinach, etc., unless they are entirely sound and free from a rancid odor, for almost all cases of botulinus poisoning in America are caused by such foods.

Don't fear to eat sound fruits, either fresh or canned, as no cases of food poisoning have been traced to this cause. Apples and pears are safe if peeled.

If you must eat in a place where you have no confidence in the sanitary conditions or care in the kitchen, stick to roast beef, potatoes, bread and butter, fruit, and coffee or tea, for these foods are the least hazardous. In doubtful environments shun cream soups and sauces, cream-filled desserts and prepared foods containing gelatin, for these are all splendid culture media for invading bacteria.

Don't worry, if you have followed the foregoing injunctions.

We would know a great deal more about food poisoning cases and could develop more preventive measures if all cases could be promptly reported and properly investigated. All left-over food which has been served at a meal that has been followed by the sudden illness of one or more of the diners, should be placed in clean separate jars, one for each kind of food, and these should be kept under refrigeration until turned over to the investigator. This is not always practicable where reports of illness have been delayed and such left-over foods have already found their way into the garbage. The responsibility of prompt and efficient investigation of food poisoning cases lies entirely with the medical profession.

When a physician is called in to treat a case of suspected food poisoning, he should immediately try to secure all food remaining unconsumed. This should be sent as soon as possible to the nearest Federal or State laboratory where food analyses are performed. For the guidance of the chemist who is to analyze the food as much information as is available should be sent, covering the following data: Clinical features, date and time of consumption of food, quantity of food eaten by each person affected, interval of time which elapsed between

eating food and onset of symptoms, evidence as to the cause of infection, evidence as to the source of the infected food.

The chemist's work in the examination of specimens sent to him includes examinations by chemical and bacteriological methods, and feeding experiments upon laboratory animals. Such an examination, to be thorough, is time-consuming, and frequently the patient either dies or recovers before the laboratory report is completed.

This should not prevent a thorough examination in every case of suspected food poisoning, for only by the accumulation of evidence in many cases may we learn such fundamental facts as will enable cases of food infection to be treated scientifically instead of symptomatically, as is necessary at present.

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BACTERICIDAL EFFICIENCY OF ESSENTIAL OILS

By Ruth E. Miller, M. Sc.*

SEVERAL volatile oils, mixtures of two or more of these oils and and a sample of beta-naphthol were tested for their bactericidal efficiency. The phenol coefficient test was employed to determine and compare the bactericidal efficiency of these oils.

Difficulty has been experienced in such investigations due to the fact that the oils were very slightly soluble in water. Even in alcohol of 30-40 per cent. only very small quantities were dissolved as shown in a paper by H. C. Wood.[1] It was found, however, that with a mixture of alcohol 28 parts, glycerin, 22 parts, prestone 31 parts, soap 6 parts and water 13 parts, considerable amounts of the volatile oils could be dissolved without having a high enough proportion of alcohol to interfere with bactericidal results. The bactericidal efficiency of this solvent was tested and its value will be given later. The prestone was also tested and only when undiluted did it possess any bactericidal action. In some of the later experiments the prestone was omitted and the following solvent used—soap 6.6 parts, and 31 parts each of alcohol, glycerin and water. Nineteen different solutions of oils and active principles were made up and tested. A list of these solutions is given below:

Eugenol	4%	by vol., alcohol 32% by vol.
Eucalyptol	4%	by vol., alcohol 29% by vol.
Methyl Salicylate	2%	by vol., alcohol 28% by vol.
Safrol	1%	by vol., alcohol 28% by vol.
Anethol	1%	by vol., alcohol 38% by vol.
Menthol	4%	by vol., alcohol 38% by vol.
Synthetic menthol	1%	
Thymol	2%	
Ceylon Cinnamon	2%	
Cinnamic Aldehyde	1%	
Oil of Cassia	2%	(sample A)
Oil of Cassia	2%	(sample B)
Sassafras Oil	1%	
Lavender Oil	2%	
Beta-Naphthol	2%	

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Eugenol 2%; Eucalyptol 2%
Eugenol 2%; Menthol 1%
Eucalyptol 2%; Eugenol 2%; Menthol 0.5%.

Mixed Oils Total Oils 0.95%	Anise	3	Oils diluted 1-20
	Cassia	2	
	Eucalyptol	4	
	Eugenol	2.5	
	Menthol	2.5	
	Sassafras	5	
	Alcohol	35	

In all of the above solutions the solvent was added q. s. to make 100 cc.

Phenol coefficients of some of these oils, as calculated by W. M. Martindale,[2] after two minutes exposure of bacteria to oil in saponaceous solution are: Thymol 30, Cinnamon 9, Cinnamic Aldehyde 9, Cassia 6, Wintergreen 4, Lavender 4, and Eucalyptol 4.

Dr. Wood [1] gives the phenol coefficient of oil of Cinnamon as about 12, Cloves about 18, and Eucalyptol about 1.

Preliminary tests were made to determine the greatest dilution which would kill bacteria. Two test organisms were used, B. typhosus (Hopkins strain) and Staphylococcus albus. Five cc. of each dilution were mixed with 0.1 cc. of a twenty-four hour culture of the organism. Transplants into 10 cc. bouillon were made after 2, 4, 6, 8, 10, 20 and 30 minutes contact of dilutions and organisms. The tubes were incubated at 37 degrees C. for forty-eight hours and readings made.

As only three solutions killed the Staphylococcus albus in dilutions weaker than 1-5, no further tests were made with that organism.

The solutions which were efficient when diluted more than 1-5 are as follows:

Thymol	2%	1-25 dilution	killed	in	2	minutes	time
Beta-Napthol	2%	1-5	"	"	4	"	"
Eugenol	4%	1-5	"	"	4	"	"

In the following solutions of oils the undiluted material killed in two minutes, while the 1-5 dilution showed growth in all the subculture tubes. The solutions are: Eucalyptol 4%, Methyl Salicylate

2%, Safrol 1%, Anethol 1%, Menthol 4%, Synthetic Menthol 1%, Ceylon Cinnamon 2%, Cinnamic Aldehyde 1%, Oil of Cassia 2% (samples A and B), Sassafras Oil 1%, Lavender Oil 1%, Mixed Oils (0.95%), (Eugenol 2%; Eucalyptol 2%), (Eugenol 2%; Menthol 1%), (Eucalyptol 2%; Eugenol 2%; Menthol 0.5%).

There was a lapse of time between the preliminary tests and the final phenol coefficient tests with B. typhosus. In this time (one year) there was a decrease in efficiency of some of these solutions.

The following solutions were less efficient bactericidally—Thymol 2%, Eugenol 4%, Menthol 4%, (Eugenol 2%; Eucalyptol 2%; Menthol 0.5%), (Eugenol 2%; Eucalyptol 2%), Oil of Cassia 2% (sample B), Cinnamic Aldehyde 1%, Mixed Oils (0.95%), Lavender 2%, Sassafras 1%, Synthetic Menthol 1%, Safrol 1%, Eucalyptol 4%, and Beta-Naphthol 2%.

The following five solutions did not show any decrease in bactericidal action: (Eugenol 2%; Menthol 1%), Oil of Cassia (sample A) 2%, Methyl Salicylate 2%, Anethol 1%, and Ceylon Cinnamon 2%.

For the final tests a fresh solution of eugenol was prepared using oil from a different batch of eugenol than was used for the first solution. Quite a difference in bactericidal efficiency between these two eugenol solutions was noted (see tables). The decrease in bactericidal efficiency over a year's time for the same eucalyptol (4%) solution was marked and those results are also given in the tables.

The majority of the solutions of oils remained clear but the following changes in appearance over a year's time were noted: the thymol darkened slightly, the mixture of oils (0.95%) was slightly clouded, the sassafras oil had a heavy flocculent sediment which dissolved on shaking, beta-naphthol became darker in color, and the (Eugenol 2%; Eucalyptol 2%; Menthol 0.5%) mixture showed the separation of oil globules while the liquid changed from a clear pale yellow to a cloudy brown color.

The following table gives the percentage of oil and the dilutions of the oil or oils in each solution which are efficient in two and a half and fifteen minutes.

A—dilution of the solution killing in 2.5 and 15 minutes.

B—dilution of the active principle killing in 2.5 and 15 minutes.

C—percentage of oil in each dilution given in column A.

	2.5 Minutes			15 Minutes		
Solution	A	B	C	A	B	C
Thymol 2%	1/45	1/2250	0.044	1/60	1/3000	0.033
Eugenol 4% (first sol.)	1/30	1/750	0.13	1/45	1/1125	0.088
Eugenol 4% (second sol.)	1/5	1/125	0.8	1/18	1/450	0.22
Beta-Naphthol 2%	1/15	1/750	0.13	1/30	1/1500	0.066
Menthol 4%	1/10	1/250	0.4	1/30	1/750	0.130
Oil of Cassia 2% (A)	1/9	1/450	0.22	1/13	1/650	0.15
Oil of Cassia 2% (B)	1/5	1/250	0.4	1/15	1/750	0.133
Ceylon Cinnamon 2%	*und.**	—	2.0	1/14	1/700	0.14
Cinnamic Aldehyde 1%	1/4	1/400	0.25	1/8	1/800	0.12
Synthetic Menthol 1%	*und.*	—	1.0	1/12	1/1200	0.083
Sassafras Oil 1%	*und.*	—	1.0	1/5	1/500	0.20
Lavender Oil 2%	*und.*	—	2.0	1/10	1/500	0.20
Eucalyptol 4% (first year)	1/2	1/50	2.0	1/10	1/250	0.40
Eucalyptol 4% (second year)	*und.*	—	4.0	1/4	1/100	1.0
Methyl Salicylate 2%	1/2	1/100	1.0	1/5	1/250	0.40
Safrol 1%	*und.*	—	1.0	1/3	1/300	0.33
Anethol 1%	*und.*	—	1.0	1/2	1/200	0.50
Mixtures						
Eugenol 2% }	1/20	1/1000	0.1	1/35	1/1750	0.05
Menthol 1% }	1/20	1/2000	0.05	1/35	1/3500	0.02
Eugenol 2% }	1/15	1/750	0.13	1/25	1/1250	0.08
Eucalyptol 2% }	1/15	1/750	0.13	1/25	1/1250	0.08
Menthol 0.5% }	1/15	1/3000	0.03	1/25	1/5000	0.08
Eugenol 2% }	1/15	1/750	0.13	1/20	1/1000	0.10
Eucalyptol 2% }	1/15	1/750	0.13	1/20	1/1000	0.10
Mixed Oils 0.95%	1/5	—	0.19	1/10	—	0.095

The abbreviation *und.* means *undiluted.*

*The solvent itself exerted bactericidal action when undiluted, but not if diluted 50%. For this reason phenol coefficients are not calculated for the active principles of those solutions which are bactericidal in 2.5 minutes only when undiluted.

The Hygienic Laboratory Method[8] for determining phenol coefficients was followed, and the figures given below are the phenol coefficients for these solutions and their active principles.

A—phenol coefficient of the solution.

B—phenol coefficient of the oil or active principle.

Solution	A	B
Thymol 2%	0.55	27.6
Eugenol 4% (first solution)	0.38	9.7
Eugenol 4% (second solution)	0.11	2.7
Beta-Naphthol 2%	0.22	11.4
Menthol 4%	0.20	5.1
Oil of Cassia 2% (Sample A)	0.11	5.7
Oil of Cassia 2% (Sample B)	0.09	4.9
Cinnamic Aldehyde 1%	0.06	6.1
Ceylon Cinnamon 2%	0.06	...
Synthetic Menthol 1%	0.06	...
Eucalyptol 4% (first year)	0.05	1.44
Eucalyptol 4% (second year)	0.02	...
Lavender 2%	0.05	...
Methyl Salicylate 2%	0.03	1.76
Sassafras Oil 1%	0.02	...
Safrol 1%	0.019	...
Anethol 1%	0.015	...

Mixtures

Mixture	A
Eugenol 2%, Menthol 1%	0.28
Eucalyptol 2%, Eugenol 2%, Menthol 0.5%	0.20
Eucalyptol 2%, Eugenol 2%	0.18
Mixed Oils 0.95%	0.07

The above figures indicate that when two or more of these oils or their active principles in a solvent of 31 parts each of alcohol, glycerin and water and 6.6 parts of soap are mixed, their bactericidal efficiency is enhanced. The resulting mixture has a greater bactericidal efficiency than is obtained when each active principle is used separately and in larger amounts.

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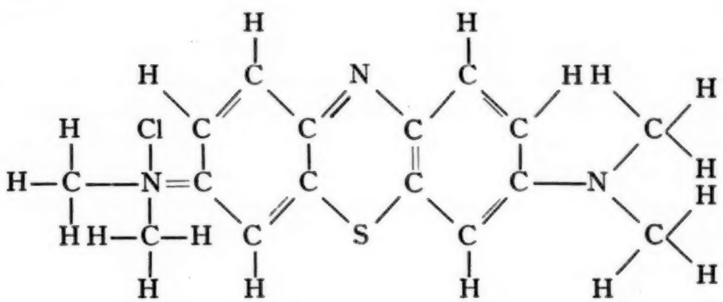
AN ELECTRONIC EXPLANATION AND HYPOTHESIS

By J. Hampton Hoch†

METHYLENE BLUE is widely used in the dye industry and in biological technique. It is official in the U. S. P. as Methylthioninae Chloridum. This compound consists of two six-membered carbon rings bound together by a condensed six-membered ring which contains one nitrogen and one sulphur atom. It belongs to the group of thiazin* substances and is regarded as a thionine derivative, *i. e.*, tetra-methyl thionine chloride.



Thunberg, writing in the *Quarterly Review of Biology* on the "Hydrogen-Activating Enzymes of the Cells," says, "A point of interest is the question of what changes take place in the Mb molecule when, under the influence of a reducing agent, it is changed to its leuco-form. Generally this reaction is expressed in the following simple way:

$$Mb + H_2 = MbH_2$$

This equation is permissible for some practical purposes, but is open to the objection that it will easily cause misunderstandings. It must not be taken to mean that the ring structure remains unchanged when Mb is reduced. As a matter of fact the quinoid binding with its two double bonds is changed to a benzoid binding. Since the dye character depended on the quinoid binding it is obvious that in this way the substance must be decolorized.

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*The thiazins are a part of the quinonimide group of dyes, having a cyclically bound imide group.

†School of Pharmacy, Medical College of the State of South Carolina.

The equation given above seems to explain the introduction of two hydrogen atoms in the Mb molecule. This needs to be explained.

When speaking of Mb we mean in reality some Mb salt, usually the chloride. It seems likely that Mb appears as an ion in the pure water solution of its chloride. The chemical equation expressing the transformation of Mb under the influence of reducing agents can be based on the salt formula. The more simple formula given above will then appear in the following form:

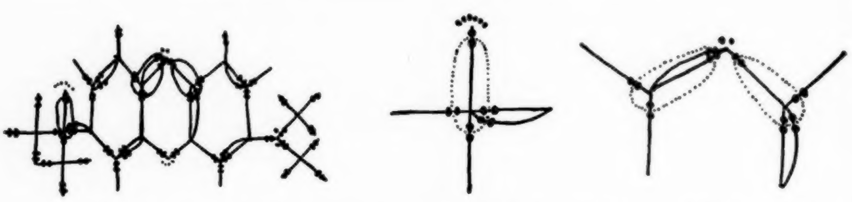
$$MbCl + H = MbHCl$$

It may be objected that although the constitution of the Mb molecule allows the formation of a chloride, this is not the case with the leuco-Mb molecule. But it may on the other hand possibly give rise to a hydrochloride. This hydrochloride of leuco-Mb will, however, rapidly dissociate giving off hydrochloric acid with change of the 5-valent nitrogen to 3-valent. Thus, if Mb is reduced—for which two atoms of hydrogen are necessary—we obtain one molecule MbH and in addition one molecule free hydrochloric acid. Notwithstanding the different final fates of the two H-atoms in question, we may very well use the short formula given above, since we are entitled to assume that the leuco-MbHCl appears at least as a transitory product."

As an hypothesis to explain the changes involved and the cause of these changes we offer the following:

The molecule of MbCl has three "spheres of electron excentricity." The two atoms of hydrogen are added to the molecule at those places where they will succeed best in reducing the "excentricity."

If we draw an electronic structure symbol* of the molecule our phrase "sphere of electron excentricity" will be evident.



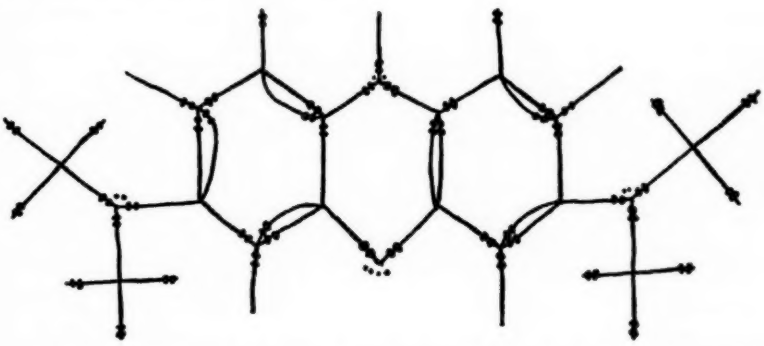
The first atom of hydrogen will attach itself to the chlorine, the most negative atom having an electron in an "excentric sphere." The

*See "The Electronic Structure of Organic Compounds," by I. W. D. Hackh in American Journal of Pharmacy for August, 1930.

elimination of the chlorine electron results in the nitrogen electron being drawn in toward its proton. This change causes one of the double carbon-nitrogen bonds to break up, thereby adding a second free valence electron to the nitrogen atom and establishing the "electron equilibrium."

The second atom of hydrogen will attach itself to the cyclic nitrogen atom, the only other negative atom having an electron in an "excentric sphere." As a matter of fact it has two electrons in a "doubly excentric sphere" and one electron in another "excentric sphere." The result will be the dissolution of the double N-C bond with the subsequent change of the "doubly excentric sphere" to the "excentric" condition.

The electronic structure symbol for the leuco-methylene blue base will illustrate the rearrangement.



The objection may be raised that there still remain two "excentric spheres" in the leuco-base. True, the two hydrogen atoms have removed one "excentric sphere" and reduced the "excentricity" of another, but our case hypothecates that further reduction would eliminate both these "excentric spheres."

FUMIGATION WITH FORMALDEHYDE: AN ATTEMPT TO IMPROVE STORM'S METHOD

By David Wilbur Horn and Leon E. Hunter [1]

IN ORDER to generate notable amounts of formaldehyde by expelling it from formalin, heat is necessary. In the earliest methods, lamps were used to supply this heat. The use of lamps in fumigating rooms was objected to because of the risk of fire. The desire to obviate this risk called forth first the proposal to pour the formalin into buckets in which hot bricks or hot iron bolts had previously been placed. Then the proposal was made to utilize the heat generated when lime slakes; this was put into practice by pouring formalin into buckets containing quicklime. Next, and last, it was proposed to take advantage of the heat set free when an oxidizing agent acts upon formalin; in practice the oxidizing agent is placed in buckets and the formalin poured upon it.[2]

In this laboratory the various methods in which oxidizing agents are used have been assayed.[3] The results made it evident that Storm's method,[4] using a soluble chlorate, outclassed other methods in chemical efficiency [5] and made possible fumigations at a greatly reduced cost.[6]

But in Storm's method the mixture of formalin and chlorate must be heated at the beginning from the outside, in order to initiate the oxidation.[7] Practically this is a great disadvantage. If, however, some internal source of heat could be found, the method seemed to us exceptionally promising. Since the oxidation of formalin by potassium permanganate starts itself and gives out a great deal of heat in the rapid progress of the reaction,[8] we thought to furnish the heat needed to initiate the action between chlorate and formalin by adding more or less permanganate to the chlorate before use.[9]

In this paper we present our findings. The method of assay has been fully described elsewhere in this Journal.[10] The permanganate and chlorate of potassium used were separately ground and sieved in standard sieves.[11] The only portion used in any case was the portion of the ground salt that passed a No. 60 sieve and was retained on a No. 90 sieve. The charges each time consisted of 2.5 grams of the mixed salts and 5 cc. of formalin.[12] Each result is the average of at least two independent assays. Our findings are given in the following table:

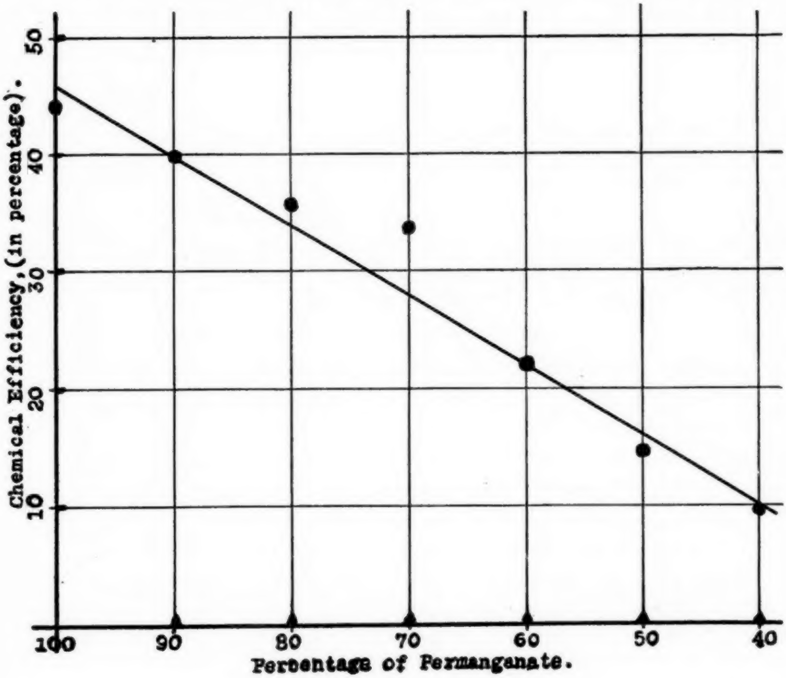
TABLE

X Per cent. Potassium Permanganate	Per cent. Potassium Chlorate	*Y* Per cent. Chemical[13] Efficiency
40	60	9.6
50	50	14.5
60	40	22.0
70	30	33.6
80	20	35.7
90	10	40.0
100	0	43.7

These data are set forth graphically in the following figure. The straight line is the locus of the equation

$$5y = 3x - 70$$

The co-ordinates of the seven points marked clearly in the graph are taken from the table above. Along the (horizontal) *X*-axis we have



plotted the per cent. of $KMnO_4$ in the solid mixture and along the (vertical) Y-axis we have laid off the chemical efficiencies.

Our conclusions are: (1) that upon a mixture of solid potassium chlorate and permanganate the chemical action of formalin is (essentially) directly proportional to the quantity of permanganate present in the mixture, and is not much influenced by the presence of the chlorate; (2) that the practical disqualification of Storm's method (*i. e.,* the need for external heating) cannot be successfully obviated by adding potassium permanganate.

The fact that the chemical efficiency is directly determined by the quantity of permanganate present is in line with the fact that in permanganate fumigations only the outer layers of the permanganate crystals are attacked and reduced by the formalin, while the deeper lying portions of the crystals remain unchanged. Although the chlorate is present, even up to 60 per cent of the solid mixture, the chemical action is directly proportional to the area of permanganate surface exposed.[14] Examination of the residues in our experiments suggests that the chlorate crystals may in the earlier stages of the reaction become sufficiently coated with manganese dioxide to keep them thereafter out of actual contact with the formalin.

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3. Horn and Osol. This JOURNAL, CI, p. 741 and ff., 1929.

4. Storm. *J. Ind. and Eng. Chem.,* X, p. 123, 1918.

5. Horn and Osol, 1929, p. 744.

6. Horn and Osol, 1929, p. 746.

7. Storm, 1918, p. 124. "No action results until the mixture is warmed by application of external heat to about 65° C."

8. Horn, 1920, p. 26.

9. We felt entirely free to undertake such experiments upon Storm's method because Storm in his paper unequivocally states that he "hopes that comparisons of the actual disinfecting efficiencies of the permanganate and chlorate methods will be made by those who may be interested in the practical side of the question and that the chlorate method may be found to be of some use."

10. Horn and Osol, 1929, p. 749 and ff.

11. Horn, 1920, p. 23, Table VII, for relation between fineness of grain of sieved permanganate and total heat evolved when acted on by formalin.

12. Horn, 1920, p. 38, Table XII, for relation between *chemical efficiency, i. e.,* the % of the total formaldehyde that is actually evolved as formaldehyde gas, and the *mixing ratio, i. e.,* the ratio of oxidizing agent (grams) used to the formalin (cubic centimeters) used. See Horn and Osol, 1929, p. 742.

13. Defined in footnote 12.

14. Horn, 1920, p. 37. "The yield increases with the weight of the permanganate used, as must be expected if the area of the surface of contact is the principal factor in this as it is in many another heterogeneous system." This referred to experiments in which no other solid than permanganate was present.

SOME MEDICINAL SUBSTANCES EMPLOYED BY THE SOUTH IN THE WAR BETWEEN THE STATES

By W. A. Prout*

FROM TIME to time there have appeared in medical and pharmaceutical journals articles dealing with the therapeutics or uses of drugs employed by the Confederate Army. A great deal of this knowledge which has come to light may be attributed to the late Dr. Joseph Jacobs of Atlanta. Dr. Jacobs spent much time gathering data which is being rapidly lost to use through the passing of our Confederate soldiers.

When war was declared between the States in 1860, there were only a few drug factories and supply depots of any size in the South. Consequently, the South was almost entirely dependent upon the European countries for its medical and surgical supplies. The lack of drugs would have caused untold suffering had it not been for the successful activities of the blockade runners and smugglers. However, after the fall of Mobile and Vicksburg, the blockade became decidedly effective which made smuggling almost impossible. As a result of this, the South was forced to turn attention to its native herbs and plants. Samuel Preston Moore, surgeon-general of the Confederate States of America, caused the establishing at several points in the Confederacy, of factories for the preparation of the drugs. In order to keep the physically fit men in the ranks, disabled soldiers were employed in the factories as far as was possible.

Upon suggestions and order of Surgeon-General Moore, Dr. Francis Peyre Porcher then lecturer in materia medica and therapeutics at the Charleston Medical College now the Medical College of the State of South Carolina, wrote a treatise on botany, the title being, "Resources of Southern Fields and Forests." This book proved extremely valuable to the Confederate Medical Corps and was widely utilized by it as it contained much valuable information on trees, shrubs and plants native to the South. Many plants whose medicinal properties were unknown to the laymen were brought into use by the Confederate surgeons.

The country people saw to it that no shortage in castor oil occurred. They raised the castor beans extensively. The oil was prepared by crushing the beans, boiling them and then skimming off the oil.

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There was a very serious shortage of opium, chloroform and quinine. The shortage of opium was forestalled by the successful cultivation of the poppy plant in Georgia, Florida, Tennessee, Virginia and the Carolinas. Much opium of high narcotic power was produced, being planted in September and collected in May. The cut, unripe capsules gave a dark green fluid similar to the Turkish variety of opium. Besides utilizing the locally produced opium, many native plants were substituted for it, such as American Hemlock and Motherwort. The chloroform manufactured was not chemically pure. However, the records of Dr. Hunter McGuire show that forty thousand administrations of the locally produced chloroform were without a single fatality. The smuggling of quinine was decidedly a profitable business. During the war, quinine sold for as high as $100 per ounce, the average selling price being around $22.25 per ounce. For the sum of $2 the Adams Express Company would guarantee the delivery to post office authorities at some point in the Confederacy, quinine placed in letters. This practice, however, was soon stopped by a strong proclamation.

Strong, warm boneset tea was administered until vomiting occurred in cases of intermittent fever. During intermissions, butterfly roots or pleurisy roots tea was substituted for quinine. Mandrake tea was given in the beginning stages of remittent fevers. The rest of the treatment being virtually the same as for intermittent fevers. Sampson's root, Virginia snakeroot, or yellow root were employed in fevers in the place of Blue Mass or Calomel. Stramonium leaves, mustard seeds or leaves, or hickory leaves were used in the form of local warm applications for pneumonia, catarrhal fevers and similar ailments. Butterfly root or sanguinaria were then given alternatively from day to day in the absence of quinine, Dover's Powder or other diaphoretics. May apple root, or peach-tree leaves, made into a strong tea was as effective a laxative as senna.

There was no lack of whiskey, for the moonshiners of Kentucky and Tennessee saw to that. Since alcohol or whiskey was almost always on hand, may tinctures were made from the native herbs. Poke root, made into a tincture, was employed in the treatment of chronic rheumatism, enlarged glands and neuralgia. Poke root tincture was often combined with Sarsaparilla root, sassafras, alder, or prickly ash. Most cases of sore throat and tonsilitis were cured by using a gargle of sage tea and honey. Raspberry or whortleberry leaves made into an infusion, was largely used in cases of diarrhœa.

Onions or garlic made into poultices were effective in glandular enlargements. Fennel seed tea was substituted for paregoric for babies. A decoction of red oak bark containing alum, was used for rash. Goose grease and sorghum or honey was a standard remedy for croup, followed with turpentine and brown sugar. In the spring and fall sassafras tea was given for purifying the blood. Horsemint tea and tea made from roots of broom sedge were employed in the treatment of colds. Blackberry cordial and tea of rose geranium were also administered in cases of diarrhœa. Mutton suet and sweet gum were employed for cuts and sores. The best known standard Georgia tonic was wild cherry, poplar and dogwood barks, equal portions finely chipped and put into whiskey which was taken by the wineglassful at meal times. It is still largely used. Black haw root was largely used in hemorrhages.

Lobelia or Indian tobacco was raised from the seeds and used as an emetic. Asthma was relieved by smoking stramonium leaves. Buckeye lotion was used for gangrenous ulcers. Cotton seed decoction was used for inflammation of mucuous membranes. By treating cotton seed directly with lye, soap was produced. The ripe china berries were employed in making whiskey; the bark of the root was used to expel worms; and "Poor Man's Soap" was made from the berries.

Holly, blackberry, raspberry and rose leaves were substituted for tea. Rye, cotton seeds, parched okra seeds, parched sweet hominy, parched sweet potatoes and peanuts being the substitute for coffee. The juice of the pulp of the maypop seeds was a popular substitute for lemonade among the farmers. Toothache bark was used to allay pain in the teeth and to this day, the South Carolina negroes depend almost exclusively upon it for rattlesnake bite.

Ink was made from the rind of the pomegranate and from poke berries. Blackberry and elderberry wines were substituted for foreign wines. The newspapers were full of directions for making soaps. The *Richmond Dispatch* and the *Wilmington Journal* published directions for making soda from sea weed and corn-cobs, and also formulas for making soaps. The peach tree furnished a number of useful things; the leaves were used instead of vanilla to season creams; the gum used instead of gum arabic; a tea of the leaves was good for whooping cough; and the leaves were used in dyeing yarns and cloth. Beer was made from maize, the persimmon and the sweet locust. Rag-weed in whiskey was employed in the place of quinine,

being used in the State of Maryland. Sea-myrtle was popular in South Carolina as a demulcent in consumption and coughs. Mountain laurel was employed in the treatment of rheumatism. Watermelon rind was used in making preserves, the juice in making syrups, and the seeds utilized as a diuretic.

Antiseptics were naturally in demand. Most of our antiseptics, however, have been discovered since the close of the war between the States. Due to the scarcity of drugs, cold-water dressing for wounds was employed by one Confederate surgeon. Later, he improved his method by adding a decoction of red oak bark to the water. This mixture promoted healing by its antiseptic and astringent properties. A weak solution of sodium bicarbonate was also employed for dressing wounds. Later, however, dry dressings proved to be more beneficial than wet dressings. Some remarkable cases were reported from the use of discarded linen and cotton goods, old sheets and cotton carded by women and children, being sterilized by washing them carefully and baking in a very hot oven.

Fate was indeed kind to the Confederate Medical Corps. They utilized no sponges for washing out wounds as did the Northern surgeons. They employed instead, rags, boiled and carefully washed and ironed with a very hot iron. Horsehair, boiled to make it pliant and sterile, was substituted for catgut and silk thread, which were unobtainable. When emollients were indicated, wahoo bark, slippery elm and a solution of common salt were employed. Poppy heads, nightshade and stramonium were used in cases of great pain.

The economy that was enjoined in the matter of supplying general and post hospitals may be of passing interest, the amounts stated being for one year for one thousand troops: acetic acid, 5 lbs.; sulphuric acid, 8 lbs.; tartaric acid, 16 lbs.; muriatic acid, 8 lbs.; arsenic, 5 ozs.; sulphuric ether, 16 lbs.; ammonia, 5 lbs.; nitrate of silver, 8 ozs.; asafoetida, 32 ozs.; adhesive plaster, 40 yds.; chloroform, 8 lbs.; copaiba, 40 lbs.; ether, 5 lbs.; camphor, 16 lbs.; white wax, 16 lbs.; alcohol, 192 pts.; creosote, 16 lbs.; extract of belladonna, 16 lbs.; buchu, 8 lbs.; calumba, 8 lbs.; morphine, 16 dr.; iodine, 16 lbs.; rhubarb, 8 lbs.; quinine sulphate, 80 to 120 ozs.; strychnine, 8 dr.; sarsaparilla, 16 lbs.; jalap, 16 ozs.; aloes, 32 ozs.; sugar, 160 lbs.; magnesium sulphate, 5 lbs., and mercurial ointment, 8 lbs.

In order to give an idea of the prices prevailing in Richmond, June, 1863, the following articles in the original invoices of R. W. Powers purchased from Kent, Paine and Company are appended:

bicarbonate of soda, \$2.75 per pound; camphor, \$20 per pound; tartaric acid, \$2.25 per pound; salt, 44 cents per pound; hops, \$2.50 per pound; 1 cask of French brandy, \$52 gallon; phosphorus, \$14 per pound; oil of peppermint, \$16.50 per pound; Epsom salt, \$3.87½ per pound; citric acid, \$4.50 per pound; quinine, \$22.25 per ounce; and morphine, \$28 per drachm.

There is, undoubtedly, other data on this subject which may be lost to history unless recorded before all of the Confederate soldiers will have passed away.

MEDICAL AND PHARMACEUTICAL NOTES

Detection of Isopropyl Alcohol in Spirituous Preparations—The following method has been tested by the author on 124 preparations consisting of liniments, cosmetics, brandies, spirits, and tinctures:—The sample (10 C.c.) is distilled on a water-bath into a container immersed in ice-water until no more alcohol is evolved; 0.3 C.c. of distillate shaken with 0.7 C.c. of a mixture of 80 C.c. of absolute alcohol and 20 C.c. of water, and a solution of 0.1 Gm. of hydroxylamine hydrochloride in 3 C.c. water added. The mixture is shaken, 0.4 Gm. of charcoal added, and filtered. Five C.c. of a freshly prepared 0.5 per cent. solution of piperonal in absolute alcohol are added, followed by the slow addition of 20 C.c. of sulphuric acid (sp. gr. 1.84). The mixture is shaken and placed on the water-bath for five minutes, when a red color indicates the presence of isopropyl alcohol, and a green-brown color its absence. If 30 C.c. of 30 per cent. acetic acid are added, a rose to red color, stable for thirty minutes, is a positive reaction (brown in the presence of small amounts of the alcohol), whilst a colorless solution or weak red tinge stable for a minute and turning yellow-grey or colorless shows the alcohol to be absent. The sensitiveness is, in general, 1 to 2 per cent. Formaldehyde, if present, must be destroyed before distillation by heating the sample with 5 C.c. of NaOH solution (sp. gr. 1.125) under a reflux for one hour. Less than 20 per cent. of acetone has no influence on the reaction.—G. Reif (*Z. Unters. Lebensm.*, 1930, *191*, 243, through *Analyst*, vol. lvi., No. 659, 1931, 115).

Asparagin—The rare and expensive biochemical product, asparagin, formerly obtainable only by importation from Europe, can now be produced in the United States on a commercial basis, according to an announcement by the U. S. Department of Agriculture. Dr. M. Dorset, chief of the Biochemic Division of the Bureau of Animal Industry, reports the successful production of asparagin in

the division's laboratory and the receipt of a shipment of the chemical as produced by the first firm to undertake its manufacture commercially.

Asparagin is used in the United States and elsewhere in laboratory studies of tubercle bacilli and in research work on the control and eradication of tuberculosis. The organisms of this disease make exceedingly good growth on culture media containing asparagin. This product is highly desirable in research work because its use permits the elimination of variable factors present in other media on which tubercle bacilli have been grown.

In the manufacture of tuberculin for testing cattle for tuberculosis, asparagin may possibly take the place of beef broth and peptone as a source of nitrogen, a change which would simplify manufacture. The Department of Agriculture alone makes 15,000,000 doses of tuberculin each year. Asparagin is a natural constituent of certain plants, particularly the lupines and vetches. In the department's investigations, the best yields were obtained from the plant known scientifically as *Lupinus albus*. Twelve-day-old seedling plants of this lupine, when dried, yield as much as 27 per cent. of asparagin. Doctor Dorset started investigations about three years ago with the co-operation of Dr. O. F. Black, of the Bureau of Plant Industry, who was the first in this country to produce the pure crystalline asparagin. The more recent experimental work was done in the Biochemic Division by P. W. LeDuc.

The process, as developed by the department's scientists, involves the growing of suitable plants, drying and grinding the stalks when the stalks are in the seedling stage of growth, extracting the asparagin with a solvent, precipitating impurities, and finally concentrating the clear solution by evaporation, whereupon the asparagin is obtained in the form of small, white crystals that are practically chemically pure.

STUDYING INDIAN PLANTS—A collection of the roots, herbs, and bulbs which the North American Indians used for food in the days before the white man came—and numbers of those which are still used by the Indians—was one feature of the U. S. Department of Agriculture's exhibit at the Thirteenth Exposition of Chemical Industries recently held in New York.

The specimens shown were only a few of the many which have been collected and analyzed by the Bureau of Chemistry and Soils in following out the Department of Agriculture's plan to investigate the tremendous latent resources of the uncultivated plants indigenous to the United States. Scientists of the department are convinced that many of these plants used by the aborigines contain valuable constituents which have been overlooked by white Americans in our present-day civilization.

"This work of the department has emphasized the fact that Indian foods differ in some respects from those consumed today by the white population of the United States. In our present civilization we are starch eaters and eat few plants which contain inulin, (the word is inulin, not insulin) but the Indians and Chinese use much inulin, which is contained in some bulbs, roots and herbs," says H. S. Paine of the Carbohydrate Division of the Bureau of Chemistry and Soils.

In explaining the significance of inulin, Mr. Paine pointed out that starch, stored as a reserve material in many plants, is a compound containing dextrose, which is identical with corn sugar; but that some plants store inulin which bears approximately the same relation to the sugar levulose that starch bears to dextrose. The use of food containing levulose was once supposed by the medical profession to check the tendency toward diabetes, though doctors do not now hold this opinion so firmly. Mr. Paine, however, points out that some authorities on nutrition now consider inulin helpful in preventing diabetes. If this be true, the general use of a diet containing considerable amounts of inulin in place of starch is believed to have important possibilities.

The Bureau of Chemistry and Soils in co-operation with the Bureau of Plant Industry of the department will soon publish a list of one thousand indigenous uncultivated plants of North America and has already collected and analyzed more than one hundred different plants in order to determine their food and other values. Some of the most important and promising plants which have been studied by the scientists of the department are being grown on plots on the Pacific Coast under the supervision of the Bureau of Chemistry and Soils, with a view to further observation and study.

By the development of the most promising of these little-known plants it is hoped to produce in this country some of the plant products which must now be imported from foreign countries, and to establish new agricultural industries offering farmers of certain areas a more diversified type of farming. It is also hoped that certain of these plants will prove valuable enough so that farmers will grow them instead of some of the crops now being overproduced.

Among the most interesting plants on exhibit in New York are the prairie potato or Psoralea esculenta, which has a rather thick skin and is less susceptible to insect injury than the common variety of potato, and wild licorice, which contains a glucosidic compound, the active principle of licorice used in candies and in certain pharmaceuticals. Another is Camas, which grows in the Northwest and has a very high inulin content. This plant was used extensively by the Indians for the production of sweet sirup and is still ground into a flour by the Klamath, Nez Perce, and Shoshone Indian tribes of Utah, Idaho, Oregon, and Washington. Dry whiskey, Lophophora Williamsii, a small plant belonging to the cactus family and used by the Indians as an infusion or libation, contains an alkaloid and is very intoxicating; is also under investigation by the bureau and will be shown in New York.

Investigations by the Bureau of Chemistry and Soils pertain chiefly to the carbohydrates, or sugars and starches in these plants, but the bureau has also found in them other promising constituents.

Other features of the exhibit of the U. S. Department of Agriculture now being shown at the Exposition of Chemical Industries illustrate some recent developments of the fertilizer work of the Bureau of Chemistry and Soils, some phases of its investigations on insecticides, and recent phases of the work on casein by the Bureau of Dairy Industry.

FLUORINE IN WATER SAID TO CAUSE SPOTTED TEETH—What is believed to be definite proof that mottled and corroded teeth in Arizona are caused by the existence of fluorine in drinking water was announced by Dr. Margaret Cammack Smith, nutrition chemist of the University of Arizona.

Thirty-five school children of the St. David area in Arizona have been under constant observation and accurate data on these findings are to be released shortly.

Mottled teeth, an endemic developmental imperfection of the enamel of the teeth, first came to the attention of leading dentists in America in 1906. The existence of communities suffering from a disease of the teeth has long been known to medical science but a thorough study of the situation was first made by Dr. G. V. Black in collaboration with Dr. Frederick S. McKay in 1916.

Dr. Smith has worked out experiments with white rats and dogs in securing her results. Samples of water from the affected areas revealed abnormal amounts of fluorine in combination with some other substance, usually calcium. This calcium fluoride was found to act on the teeth of children before the teeth erupt. The sulphuric acid test revealed hydrofluoric acid in all of the tests and successfully etched glass.

However, in Dr. Smith's opinion not all of the disease is traced directly to fluorine. She believes that the condition is in addition caused by unfavorable nutrition. Dr. Smith, assisted by Miss Edith Lantz, research assistant in nutrition at the university, received accurate results in working with animals and secured mottled teeth in animals given the water with fluorine content.

Dangerous Diabetes Nostrums—"Persons suffering from diabetes should not rely on the curative claims made by manufacturers of worthless nostrums, since there is no drug nor combination of drugs known to medical science which can cure this disease," said Dr. J. J. Durrett, chief of drug control, Federal Food and Drug Administration, today, in commenting upon a recent Government seizure of a product, "Insurol," shipped by the Deutsche Vital Gesellschaft, Berlin, Germany, to a New York concern. "The only safe and reliable treatment for this disease is the continued hypodermic injection of insulin together with a suitable diet, and this is not to be considered a cure. Insulin is now recognized by medical men in the leading nations of the world as being an effective treatment, when used in conjunction with a regulated diet, but not as a cure for the disease. At the same time, every country has its favorite

herb, superstitiously believed to have curative value for diabetes. None of these herbs have cured the disease."

Analysis by Federal chemists and pharmacologists showed that the preparation, "Insurol," contained no ingredient nor combination of ingredients capable of producing the effects claimed upon the label, and thus became liable to seizure under the Federal Food and Drugs Act, which has jurisdiction over imported goods as well as those entering into interstate traffic in the United States. The pills consisted largely of some clay-like material, yeast, reducing sugar, a dried glandular substance, and smaller amounts of other material.

NEWS ITEMS AND PERSONAL NOTES

PHARMACEUTICAL SERVICE IN THE U. S. ARMY—A conference, participated in by officers of the Medical Department of the Army, including Surgeon General Merritte W. Ireland and Colonel Robert U. Patterson, who will succeed General Ireland as Surgeon General when the latter goes on the retired list on May 31st, and representatives of the American Pharmaceutical Association, was held in Washington on May 22, 1931.

During recent months, other conferences between the groups have been held with the object of working out legislation, satisfactory to the Army authorities and to the pharmaceutical representatives, for the improvement of the pharmaceutical service in the Army, including the commissioning of pharmacists—as a part of a general plan being developed to improve the Medical Department. It has been agreed that improvement and extension of the pharmaceutical service in the Army is essential to such a plan. The question still open is how this can best be done to accord with the military organization and the views of pharmacy.

The recent conference was for a further consideration of this question and also to acquaint Colonel Patterson with the progress already made toward agreement between the two groups.

A complete report of these conferences will be made by the Committee on Pharmacy Corps in the U. S. Army at the Miami meeting of the American Pharmaceutical Association which will be attended by Colonel A. D. Tuttle as the representative of the Medical Department and of the Surgeon General.

Colonel Tuttle will discuss the legislation now pending before Congress for improving and extending the pharmaceutical service in the Army and will explain the plans which the Medical Department considers as essential to effective military operation from the standpoint of experience with the public health professions in the Army. Colonel Tuttle has taken great interest in these plans and is well qualified by professional training and army experience to discuss them from the military and professional points of view.

BOOK REVIEWS

PRINCIPLES OF INORGANIC CHEMISTRY. 2d edition. Compendium and Repetitorium for students of natural science, medicine and pharmacy, by Ludwig Wolf. 230 pp., 10 text illustrations and 2 tabulations. Bound. 8 marks. Deuticke, Leipzig and Vienna.

The author, providing a brief survey, aims to assist mainly the young students in the full appreciation of the foundational facts of importance in general inorganic experimental chemistry. He discusses in the introduction (14 p.) the basic definitions and important chemical laws, and in 2 chapters (ca. 100 pp. each) the chemistry of nonmetals and metals. The elements masurium and rhenium are newly introduced in the new edition.

Taking silicon as an example, we learn of the origin of the name, the occurrence of the element or its compounds, the preparation, the properties, the use. Among the compounds the hydrogen-, oxygen-, and halogen compounds are discussed. The extremely porous silica gel, however, is not mentioned, although it represents one of the most remarkable examples of scientific and industrial developments in the last few years.

Similarly we miss in the otherwise interesting discussion of metals references to the development of new industrial alloys as rust-free steel, chromium steel, alpax (aluminum-silicon), and new industrial catalizers as titanium oxide.

There are brief but valuable references to the physiological properties of about twenty elements or their compounds. A more elaborate statement, dealing with lead states that all lead compounds, as well as lead cause severe chronical poisoning in the form of intestinal cramps, lead colic and local paralysis; even small amounts are finally poisonous, as lead containing pigments, being harmful to painters; it was preferred by mixers of poisons for its slow action. Mixtures called "inheritance powders" contained litharge—and often lead-sugar.

All in all, the booklet, first conceived in connection with elaborate lectures given by Professor Schlenk in Vienna and Berlin on general experimental chemistry, is a helpful compilation of important facts, interestingly stated.

ARNO VIEHOEVER.